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Effect of surface fertilization on growth and yield of inter specific hybrid *Bt* cotton

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ABSTRACT: A field investigation on studies on effect of surface fertilization on growth and yield of inter-specific hybrid *Bt* cotton" was carried out at Agronomy Field Unit, UAS, GKVK, Bangalore during *kharif* 2012. The experiment was laid out in randomized block design with 7 treatments and 3 replications involving treatment combinations of 3 splits (T_2 and T_3), 4 splits (T_4 and T_5) and 5 splits (T_6 and T_7) at 75 and 100 per cent dosages of RDF as compared to RDF through soil application. Surface fertilization treatments resulted in 16-46 per cent higher seed cotton yield over RDF through soil application. Among fertilization treatments, 100 per cent RDF in 5 splits recorded highest seed cotton yield (3397 kg/ha). The higher seed cotton yield in surface fertilization treatments was attributed to yield parameters like more squares formation, more flowers and more bolls.

Key words : *Bt* cotton, hybrid, RDF (Recommended dose of fertilizers), surface fertilization

Cotton (*Gossypium* spp) popularly known as "White Gold", is an important commercial fibre crop grown under diverse agro climatic conditions around the world. It provides fibre, an important raw material for textile industry. More than 70 per cent demand from Indian textile industries is met by cotton fibres. Even though, India ranks first with respect to area under cultivation, it stands third in total production after USA and China. Fertilization has been found to increase the efficiency in the application of fertilizer besides reducing the quantity of fertilizes applied. It in turn, reduces the cost of production and also minimizes the ground water pollution thereby preventing ecological disturbances and health risks occurred due to leaching and accumulation of nitrates in the deeper layers. As such, use of fertilization could prove as a blessing for Indian farming and may pave the way for efficient use of costly and scarce fertilizers. The fertilization technique is presently restricted to drip method of irrigation. In India, out of 633 lakh ha irrigated area only 4.5 lakh ha is under micro irrigation system and remaining area is under surface method of irrigation. The major limitation of drip irrigation is its higher initial investment. Applicability of fertilization technique in surface irrigation is more useful, as more irrigated area (>99 per cent) is under surface methods. Adopting fertilization under drip method also calls for use of fully soluble fertilizers to avoid clogging due to undissolved part of fertilizers. High cost and non-availability of water soluble fertilizers are the other disadvantages of drip fertilization technology. But, conventional fertilizers could be easily used in fertilization with surface methods facilitating easy adoption by more farmers. The suitability of fertilization technique in surface method of irrigation by using conventional fertilizers needs to be studied in this direction.

A field experiment on groundnut was conducted at ZARS, GKVK, Bengaluru (12º 51' N, 77º 35' E and 930 m Above Mean Sea Level) during *kharif* season of 2012. The texture of soil was red sandy loam having neutral p^h with organic carbon (0.52 %), available nitrogen (281.5 kg/ha), phosphorous (74.3 kg/ha), and potassium (198.08 kg/ha). The rainfall of 361.7 mm was received during cropping period. The daily mean maximum and minimum temperatures for the cropping period were 29.2° C and 16.2° C, respectively. The hybrid used was KDCHB-407 BG1. The experiment was laid out in a randomized complete block design with 3 replications with 7 treatments *viz.*, T_1: RDF – soil application in (1+2) splits (50%+25%+25%) T_2: Fertilization in 3 splits (33% each) - 100 per cent dose of N, P, K T_3: Fertilization in 3 splits - 75 per cent dose of N, P, K T_4: Fertilization in 4 splits (25% each) - 100 per cent dose of N, P, K T_5: Fertilization in 4 splits – 75 per cent dose of N, P, K T_6: Fertilization in 5 splits (20% each) – 100 per cent dose of N, P, K T_7: Fertilization in 5 splits – 75 per cent dose of N, P, K. The fertilizers) used in the experiment were urea, single super phosphate (SSP) and muriate of potash (MOP) as N, P and K sources, respectively. In both sets of 75 per cent and 100 per cent recommended dose, the surface fertilization was imposed using 3 splits, 4 splits and 5 splits respectively at 20, 40 and 60 DAS, 20, 40, 60 and 80 DAS and 20, 40, 60, 80 and 100 DAS. For each fertilization event, the weighed quantity of fertilizer/plot was equally divided in 7 quantities. In each plot, specified equal quantities of fertilizers were placed at beginning of row and 1 m^3 of water was supplied to each row at an average discharge of 5.4 lps. In this, the weighed quantity of fertilizers included urea, super phosphate and muriate of potash. Thus splits of all three major nutrients were achieved (RDF- 150:75:75 N, P_2O_5 and K_2O).

Growth and yield attributes: Each successive increase in number of splits under surface fertilization recorded significantly increased in plant height, monopodial and sympodial branches and the total dry matter accumulation/plant at harvest. 100 per cent RDF with fertilization in 5 splits recorded significantly higher growth attributes *viz.*, plant height (159.47 cm), number of sympodial branches (25.07) and TDM (631.12 g/plant) at harvest compared to other treatments. Further with soil application of 100 per cent RDF was recorded significantly lower growth attributes like plant height, sympodial branches and total dry matter (130.40 cm, 15.93 and 404.27 g, respectively) (Table I). The difference in the dry matter production due to different treatments can be ascribed to the leaf area production. Leaf area index is the measure of source size and significantly higher leaf area index was recorded with 100 per cent RDF with fertilization in 5 splits over all other treatments. Higher LAI contributed for more carbohydrate synthesis and better yield. The role of higher LAI in achieving faster and more accumulation of dry matter was reported in cotton by Bharathi *et al.*, (2012).

Table 1. Growth and yield attributes as influenced by surface fertilization with different splits/dosages of fertilizer in hybrid *Bt* cotton

Treatments	Growth attributes			Yield attributes		
	Plant height (cm)	Leaf area index 135 DAS	Total dry matter production (g/plant)	Sympodial branches/ plant	Bolls/ plant	Boll weight (g)
T_1: RDF-Soil application	130.40	1.73	404.27	15.93	49.47	3.50
T_2: Fertilization in 3 splits-(100%) dose	144.80	2.09	530.72	20.87	66.07	3.80
T_3: Fertilization in 3 splits-(75%) dose	137.60	1.94	454.23	17.93	57.20	3.55
T_4: Fertilization in 4 splits-(100%) dose	144.67	2.17	554.64	21.47	68.13	3.83
T_5: Fertilization in 4 splits-(75%) dose	140.00	1.98	469.40	18.33	58.27	3.62
T_6: Fertilization in 5 splits-(100%) dose	159.47	2.33	631.12	25.07	79.07	3.90
T_7: Fertilization in 5 splits-(75%) dose	145.87	2.13	547.94	21.53	68.10	3.72
S.Em ±	3.78	0.06	22.46	1.25	2.69	0.07
C.D. (p=0.05)	11.65	0.17	69.21	3.85	8.28	0.22

Table 2. Seed cotton yield as influenced by surface fertilization with different splits/dosages of fertilizer in hybrid *Bt* cotton

Tretments	SCY (g/plant)	SCY (kg/ha)	HI	Seed index (g)	Lint index (g)	Ginning (%)
T_1: RDF-Soil application	164.17	1859	0.41	11.87	7.99	40.19
T_2: Fertilization in 3 splits-(100%) dose	241.67	2732	0.45	12.13	8.55	41.33
T_3: Fertilization in 3 splits-(75%) dose	194.33	2198	0.43	11.81	8.01	40.39
T_4: Fertilization in 4 splits-(100%) dose	253.17	2857	0.46	12.38	8.88	41.73
T_5: Fertilization in 4 splits-(75%) dose	204.45	2309	0.44	12.05	8.32	40.83
T_6: Fertilization in 5 splits-(100%) dose	301.07	3397	0.48	12.46	9.68	43.70
T_7: Fertilization in 5 splits-(75%) dose	248.76	2802	0.45	12.18	8.59	41.35
S.Em ±	12.00	132	0.02	0.09	0.27	0.61
C.D. (p=0.05)	36.98	407	0.06	0.27	0.82	1.87

The yielding ability of a crop is the reflection of yield attributing characters like bolls/plant, boll weight, seed index and lint index (Table I). The different splits and dosage of fertilizers had significant influenced on these yield parameters. Among the different treatments 100 per cent RDF with fertilization in 5 splits was recorded significantly higher yield parameters such as bolls/plant (79.07), boll weight (3.90 g), seed index (12.46 g) and lint index (9.68 g) as compared to soil application and other fertilization treatments. The benefit of higher boll weight and bolls/plant in achieving higher seed cotton yield was earlier confirmed by Nalayini *et al.,* (2012).

Seed cotton yield: The data on seed cotton yield (Table 2) revealed that, surface fertilization treatments recorded significantly higher yield over soil application. Among fertilization treatments, 100 per cent RDF with 5 splits recorded highest seed cotton yield (3397 kg/ha). Application of readily usable nutrients in the form of fertilizer solution along with water resulted in the additional advantage of higher seed cotton yield over RDF soil application. The yield advantage was also due to the possibility of supplying all the major nutrients in the form of solution in 3 to 5 splits than limitation of soil applied nutrients. This advantage of fertilization could satisfy the nutrient demand at the critical stages enough to achieve the higher seed cotton yield (Reddy and Aruna, 2010). The increased in yield under fertilization than soil application have also been reported by Nalayini *et al.,* (2012) and Avudaithai *et al.*, (2009) in cotton.

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